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NATIONAL DAM SAFETY PROGRAM. HELVELY PARK DAM (MO 10584), MISSO--ETC(U)
MAR 79 P R ZAMAN, E R BURTON, H L CALLAHAN DACW43-79-C-0040

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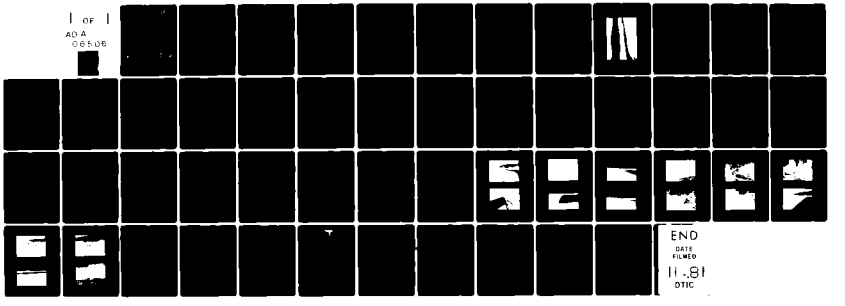

LEVEL II

(1)

MISSOURI-KANSAS CITY BASIN

HELVELY PARK DAM

CLAY COUNTY, MISSOURI

MO 10584

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

MARCH 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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MISSOURI-KANSAS CITY BASIN

HELVELY PARK DAM

CLAY COUNTY, MISSOURI

MO 10584

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
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St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

MARCH 1979

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Helvely Park Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Helvely Park Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division
18 JUL 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer
18 JUL 1979
Date

HELVELY PARK

CLAY COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10584

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

MARCH 1979

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Helvely Park
State Located	Missouri
County Located	Clay County
Stream	Tributary to Wilkerson Creek
Date of Inspection	20 March 1979

Helvely Park Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers, failure would threaten the life and property of approximately six families downstream of the dam and would potentially cause appreciable damage to the bridges of two improved roads within the estimated damage zone which extends one mile downstream of the dam.

Our inspection and evaluation indicates the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass either the probable maximum flood or 50 percent of the probable maximum flood without overtopping but will pass 20 percent of the probable maximum flood, which is greater than the estimated 100-year flood. The probable maximum flood is defined as the flood discharge which may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Based on the size of dam and downstream hazard potential, the spillway should be capable of passing 50 percent of the probable maximum flood without overtopping the dam.

Overflow through the emergency spillway may cause flood damages below the spillway.

Deficiencies visually observed by the inspection team were lack of slope protection on the front face of the dam, growth of trees and brush on the embankment, seepage, and animal burrows in the embankment.

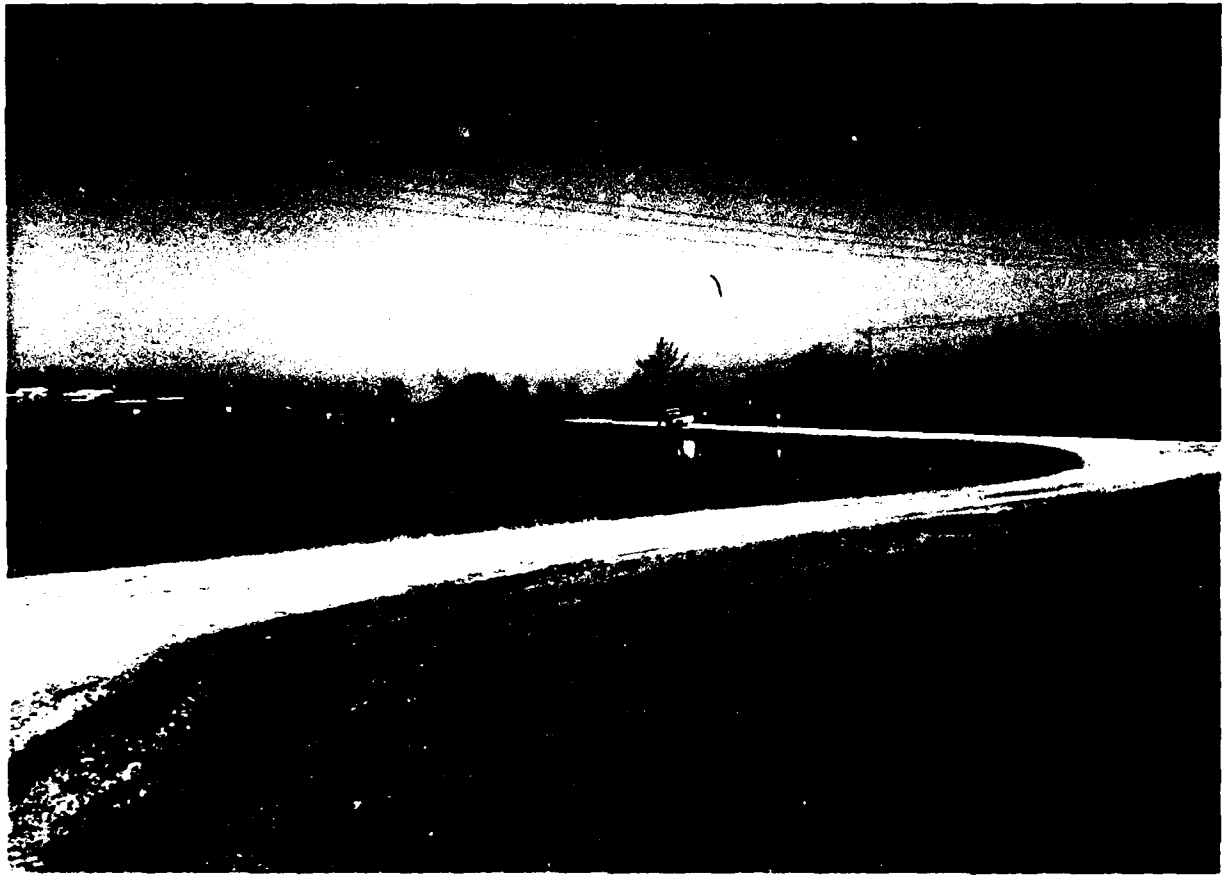
Immediate steps toward the remedy of the hydraulic inadequacy of the spillway are needed. There are no other observed deficiencies or

conditions existing at the time of the inspection which indicate an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, detailed seepage and stability analyses of the existing dam, as required by the guidelines, should be performed. A detailed report discussing each of these deficiencies is attached.

Paul R. Zaman, PE
Illinois 62-29261

Edwin R. Burton, PE
Missouri E-10137

Harry L. Callahan, Partner
Black & Veatch



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
HELVELY PARK
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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection be made of the Helvely Park Dam, listed in the 1973 Inventory of Missouri dams as No Name 169 Dam.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the valley of a tributary to Wilkerson Creek near its confluence with the Little Platte River in northwestern Clay County, Missouri (Plate 1). The embankment consists of an abandoned railroad embankment which may have been modified or improved to form the dam. The dam is 800 feet long with a tip width of 20 feet. Topography of the contributing watershed is characterized by rolling hills. The watershed is primarily comprised of grassland pasture. Topography in the vicinity of the dam is shown on Plate 2.

(2) The primary spillway is located 50 feet upstream from the axis of the dam at the approximate center. The drop inlet type spillway consists of a corrugated metal pipe vertical shaft connected to a corrugated metal pipe conduit through the embankment which discharges to a natural channel. The discharge channel is composed of soil with some gravel in the streambed, and shale and limestone outcroppings along the right bank. There is a moderate cover of trees along the channel banks.

(3) The emergency spillway is located in the left abutment 165 feet upstream from the axis of the dam. The emergency spillway is a notch cut in the natural overburden at an elevation slightly lower than

the crest of the spillway approach. Discharge through the emergency spillway overflows into the adjacent valley, then drains through a culvert under the old railroad embankment. The north slope of this valley is being developed for residential use.

(4) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in northwestern Clay County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Smithville, Missouri in Section 26 of T53N, R33W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the small size category.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: The Helvely Park Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, agricultural, industrial and commercial facilities, and to important public utilities, main highways, or railroads. For the Helvely Park Dam the estimated flood damage zone extends downstream for 1.0 mile. Within the damage zone are six homes and two road bridges.

e. Ownership. The dam is owned by the City of Smithville, City Hall, 108 North Bridge Street, Smithville, Missouri 64089.

f. Purpose of Dam. The dam forms a 13-acre water supply lake.

g. Design and Construction History. Data relating to the design and construction were not available.

h. Normal Operating Procedure. The reservoir impounded by the Helvely Park Dam is the main water supply for the City of Smithville. Water is drawn from the lake through a 4-inch suction line and pumped to the city's treatment plant located at the southeast end of the dam. The water level in the lake is maintained relatively stable near the top of the primary spillway by pumping water into the lake from the Little Platte River. In the future, the city plans to take their water supply from the Corps of Engineer project on the Little Platte River which is under construction. Helvely Park Lake will then be maintained as a recreational lake.

1.3 PERTINENT DATA

a. Drainage Area - 169 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through an uncontrolled primary spillway.

(2) Estimated experienced maximum flood at damsite occurred on July 19, 1965 when 11 inches of rain fell during a 24 hour period. No information is available regarding the dam performance during this flood.

(3) Estimated ungated combined spillway capacity at maximum pool elevation - 200 cfs (top of Dam El.842.3).

(4) Water is pumped from lake through a 4-inch suction line to water treatment plant. Maximum pumping capacity is 700 gallons per minute (approximately 3 acre feet/day).

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 842.3 ± (see Plate 3)

(2) Primary spillway crest - 840.0

(3) Emergency spillway crest - 841.1

(4) Streambed at centerline of dam - 805.5 ±

(5) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 1,250 feet ±

(2) Length of normal pool - 1,200 feet ±

e. Storage (Acre-feet).

(1) Top of dam - 203 (estimated)

(2) Primary spillway crest - 159 (estimated)

(3) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 16

(2) Primary spillway crest - 13

g. Dam.

(1) Type - Earth embankment

(2) Length - 800 ± feet

(3) Height - 37 feet ±

(4) Top width - 20 feet

(5) Side slopes - Varies (see Plate 4)

(6) Zoning - Unknown.

(7) Impervious core - Unknown.

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel - None.

i. Emergency Spillway.

(1) Type - Grass open channel.

(2) Width of spillway - 43 feet.

(3) Crest elevation - 841.1 feet m.s.l.

(4) Gates - None.

(5) Upstream channel - Grass and bare soil.

(6) Downstream channel - Grass valley with no defined channel.

j. Primary Spillway.

(1) Type - Drop inlet and vertical shaft.

(2) Size of orifice - 48 inch.

(3) Crest elevation - 840.0 feet m.s.l.

(4) Upstream channel - Not applicable.

(5) Downstream channel - Natural stream.

k. Regulating Outlets - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data were unavailable. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record.

2.2 CONSTRUCTION

Construction records were unavailable, however the dam was reportedly built between 1959 and 1960.

2.3 OPERATION

The maximum recorded loading on the dam is unknown. Information regarding operation and maintenance was obtained verbally from the city water superintendent, Mr. Curtis Burchette.

2.4 GEOLOGY

The Helvely Park Dam is located across a broad shallow valley which contains a small intermittent tributary of Wilkerson Creek. The soils of the valley are classified as the Knox Silt Loam soil series. The Knox series was developed by weathering of wind-deposited silt (loess) originating from glaciated rocks and soils. It is anticipated that either glacial till and/or residual soil underlie the Knox series. Some alluvial soil may also be present. The bedrock consists of limestone and shale of the Kansas City Group of the Pennsylvanian Period.

2.5 EVALUATION

a. Availability. No engineering data could be obtained.

b. Adequacy. No engineering data were available upon which to make a detailed assessment of the design, construction, and operation. Detailed seepage and stability analyses should be performed as required by the guidelines.

c. Validity. The validity of the design, construction, and operation could not be determined due to the lack of engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Helvely Park Dam was made on 20 March 1979. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and geotechnical engineering. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following items at the dam. In general, the embankment appeared to be in good condition. One large tree (12 inches in diameter) was growing in the upstream face of the dam and several large trees (2 to 12 inches) were growing in the back slope near the center of the dam. Slope protection on the front face of the dam consisted of 2 to 6 inch crushed limestone below the waterline and grass above. Some minor erosion of the front face due to wave action was observed. The back slope of the dam was protected by a good grass cover; however, some isolated bare spots with minor erosion were observed. Clear seepage estimated at one gallon per minute was observed in the general area of a shale and limestone outcrop along the right bank of the discharge channel. Nonflowing seepage was observed in natural material in the area of the left abutment along the back slope and on the north slope of the ridge forming the left abutment, (See Plate 3). A few small animal burrows were observed in the embankment. There was no evidence of sliding, cracking, settlement, or sinkholes.

c. Appurtenant Structures. The inspection team observed the following items pertaining to appurtenant structures. The primary spillway consists of a 48-inch corrugated metal pipe vertical shaft connected to a 48-inch corrugated metal pipe conduit through the dam. The lake level was approximately 0.5 foot below inlet. Only a few inches at the inlet and outlet ends were observable. The pipe appeared to be in good condition with no rust or corrosion. Leakage into the vertical section was audible. According to the water plant superintendent, the leakage was occurring at the pipe joint four feet below the top. Flow from the primary spillway was estimated at 2 to 3 gallons per minute. The emergency spillway consists of a notch cut through the natural overburden of the left abutment. A brush covered fence crossed the spillway channel. The channel was partially grass covered CL soil. Downstream from the emergency spillway is a shallow valley which drains through the old railroad embankment through a box culvert. New houses have been built along the north slope of this valley.

d. Geology. A visual inspection of the soils and geology of the dam confirmed the presence of silt-loam soil overlying residual silty clay soil. Some alluvial sand and gravel are present in the downstream

channel below the dam. An outcrop of limestone is present in the right bank of the downstream channel. The outcrop section consists of approximately six feet of thin bedded limestone with vertical, widely-spaced joints and open bedding-planes. Ground-water discharge at an estimated rate of one gpm was observed at one place near the upstream base of the limestone outcrop. The materials in the foundation and abutments of the dam are unknown. They are anticipated to be alluvial, loessal and/or residual silty-clay soils overlying limestone bedrock.

e. Reservoir Area. No slides or excessive erosion due to wave action were observed along the shore of the reservoir. Topography of the contributing watershed is characterized by rolling hills. The vegetation in the watershed is primarily comprised of grassland pasture and meadow.

f. Downstream Channel. The natural channel downstream from the primary spillway consists of a gravel streambed. Some outcropping of shale and limestone is visible along the right bank. The stream banks are covered with brush and trees.

3.2 EVALUATION

Maintaining the lake at its present high level with very minimal freeboard greatly increases the danger of overtopping which could lead to failure of the dam. There is also a serious potential of flood damages occurring from overflow through the emergency spillway. Additional protection is needed along the front face of the dam to prevent further erosion of the embankment. The growth of trees and brush on the embankment needs to be controlled to prevent deterioration of the dam. Seepage below the dam does not appear to be a problem; however, it should be monitored regularly. There were a few small animal burrows observed in the embankment which should be eliminated to prevent the increase in the animal population.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool is normally controlled by rainfall, runoff, evaporation, water usage and capacity of the uncontrolled spillway. During dry periods of heavy usage, water in the reservoir is maintained at near primary spillway level by pumping water into the lake from the Little Platte River.

4.2 MAINTENANCE OF DAM

There is no regularly scheduled program for maintenance. Grass and brush on the embankment is cut periodically as needed. The placement of additional riprap on the front face of the dam is planned.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities are known to exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN AFFECT

There is no existing system or preplanned scheme for warning occupants of the hazard zone below this dam.

4.5 EVALUATION

One large tree (12 inch diameter) on the front face and several larger trees on the back slope of the embankment have been allowed to grow. Some areas of minor erosion and a few small animal burrows exist on the embankment. If these deficiencies are unchecked, they could lead to deterioration of the dam embankment.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Design data pertaining to hydrology and hydraulics were unavailable.

b. Experience Data. The drainage area and lake surface area are developed from USGS Smithville and Nashua Quadrangle Map. The spillway and dam layouts are from surveys made during the inspection.

c. Visual Observations.

(1) The 48-inch corrugated metal pipe of the principal spillway appears to be in good condition. There is a leaky joint in the pipe approximately four feet below normal pool. Although there was no riprap at the outlet of the discharge pipe of the principal spillway, the discharge channel appeared in good condition with little erosion.

(2) The emergency spillway channel is in good condition with no evidence of erosion at the time of the inspection. There is a brush covered wire fence across the emergency spillway channel which will cause minor resistance to flows.

(3) Spillway releases will not endanger the integrity of the dam.

(4) There are no facilities available which could serve to draw down the pool except the 700 gallon per minute water supply pumps.

(5) The principal spillway is located near the center of the dam approximately 50 feet from the centerline of the dam. The emergency spillway is located in the left abutment.

(6) The road which crosses the watershed above the lake was assumed to have no restrictive effect on flow into the lake.

d. Overtopping Potential. The spillway will not pass the probable maximum flood without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass 20 percent of the probable maximum flood without overtopping. This flood is greater than the 100-year flood estimated to be 610 cfs developed by a 24-hour, 100-year rainfall. According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of small size should pass 50 percent of the probable maximum flood. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 2,760 cfs of the total discharge from

the reservoir of 2,960 cfs. The estimated duration of overtopping is 5.8 hours at a maximum depth of 1.1 feet over the dam. The portion of the estimated peak discharge of 50 percent of the probable maximum flood overtopping the dam would be 1,190 cfs of the total discharge of the reservoir of 1,390 cfs. The estimated duration of overtopping is 3.8 hours at a maximum depth of 0.7 foot over the dam. There was evidence that the silty clay soils observed in the embankment are susceptible to erosion. Prolonged overtapping of the dam would cause erosion which could lead to failure. There was no evidence that the dam has been overtapped in previous years. Failure of upstream water impoundments shown on the 1975 revised USGS map would not have a significant impact on the hydrologic or hydraulic analysis.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately one mile downstream of the dam. There are six homes and two improved road crossings downstream of the dam which could be severely damaged and lives could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found. Detailed seepage and stability analysis should be performed as required by the guidelines.

c. Operating Records. No operational records exist.

d. Post Construction Changes. The primary spillway shaft has been extended twice since original construction. Each extension added a 4 foot section of pipe to the top of the spillway. As a result, the present normal water level is 8 feet higher than the original normal water level.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The primary concern is the danger of overtopping the dam due to the hydraulic inadequacy of the spillway and to the high lake level. Also overflow through the emergency spillway has a potential for causing flood damage below the spillway. Other observed deficiencies are less serious; however, if unchecked they could develop into potentially hazardous problems. These deficiencies are the lack of slope protection on the front face of the dam, growth of trees and brush on the embankment, seepage, and animal burrows in the embankment.

b. Adequacy of Information. Due to the lack of engineering design data, the conclusions in this report were based only on performance history and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. However, seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. It is the opinion of the inspection team that immediate steps be taken to remedy the hydraulic inadequacy of the spillway. Remedial measures of lesser urgency should be implemented as soon as possible.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam or identify any serious dangers that would require a Phase II investigation.

e. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

7.2 REMEDIAL MEASURES

a. Alternatives. The present spillway has the capacity to pass 20 percent of the probable maximum flood without overtopping the dam. In order to pass 50 percent of the probable maximum flood as required by the Recommended Guidelines, the spillway size and/or height of dam would need to be increased or the lake level would need to be lowered to increase storage capacity. The extent and of flooding in the adjacent valley due to emergency spillway overflows should be investigated. It is the opinion of the inspection team that the freeboard above the spillway crest is inadequate when compared to current design practices.

b. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

(1) Erosion protection should be added on the upstream slope of the dam to prevent erosion of the embankment material due to wave action.

(2) Due to the existence of the trees and brush on the downstream slope of the dam, an engineer experienced in the maintenance and design of earthen dams should be retained to recommend procedures to control the growth of the trees and establish proper slope protection.

(3) Check the downstream face of the dam periodically for seepage and stability problems. If seepage flows are observed or sloughing on the downstream embankment slope is noted, the dam should immediately be inspected and the condition evaluated by an engineer experienced in design and construction of earthen dams.

(4) The existing small animal burrows should be excavated, filled, and compacted under the direction of an engineer experienced in earthen dams, and a program of pest control should be established to reduce the animal population.

(5) An engineering study should be made to determine the severity of potential flooding of new development in the area north of the lake which could result from emergency spillway overflows.

(6) Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

(7) A detailed inspection of the dam should be made at least every year by an engineer experienced in design and construction of dams. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increases.

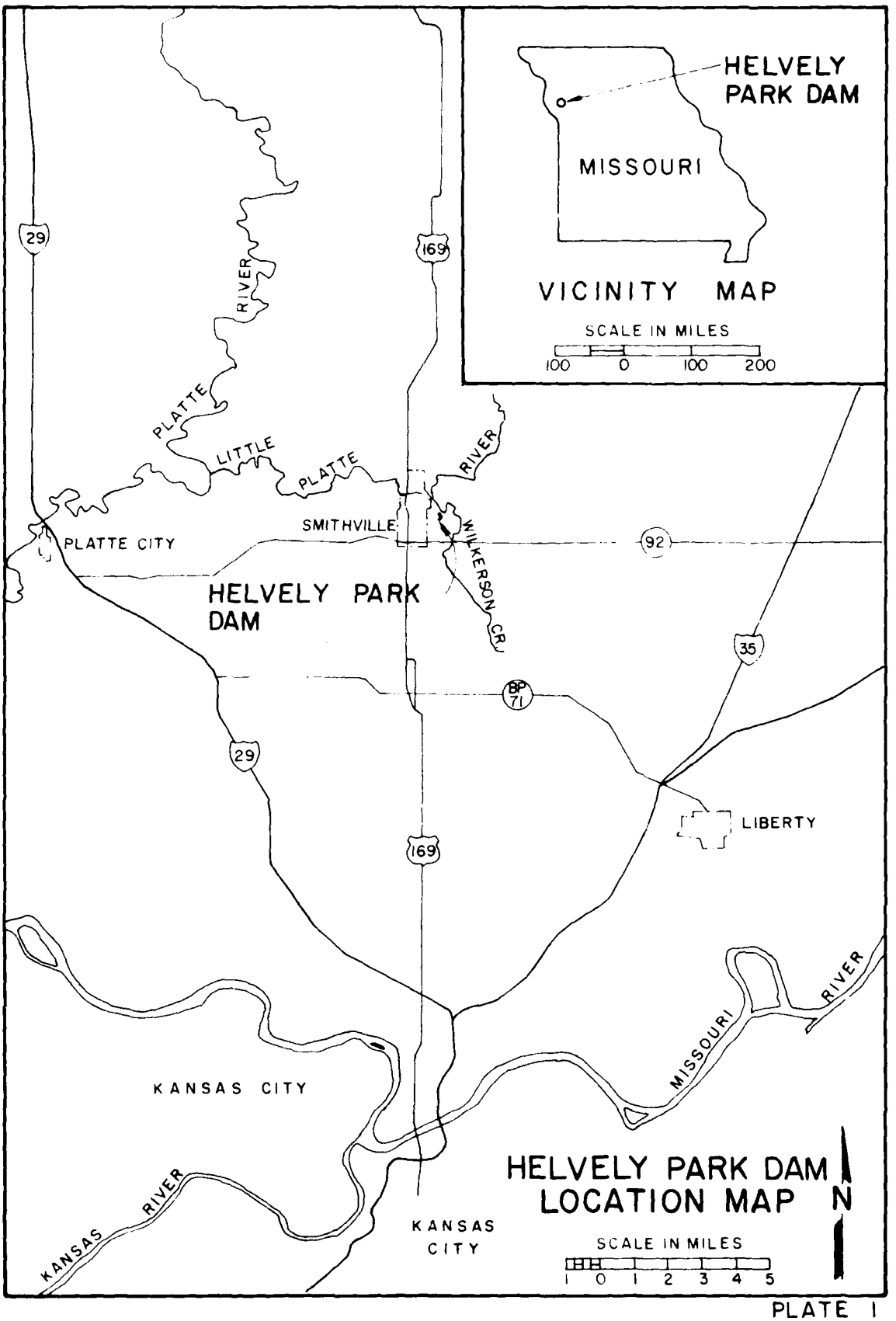

HELVELY
PARK DAM
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
29
169
RIVER
PLATTE
LITTLE
PLATTE
RIVER
SMITHVILLE
PLATTE CITY
92
WILKERSON CR.
HELVELY PARK
DAM
35
BP
71
29
169
LIBERTY
KANSAS CITY
MISSOURI
RIVER
KANSAS
RIVER
KANSAS
CITY
HELVELY PARK DAM
LOCATION MAP
N
SCALE IN MILES
1 0 1 2 3 4 5

PLATE 1

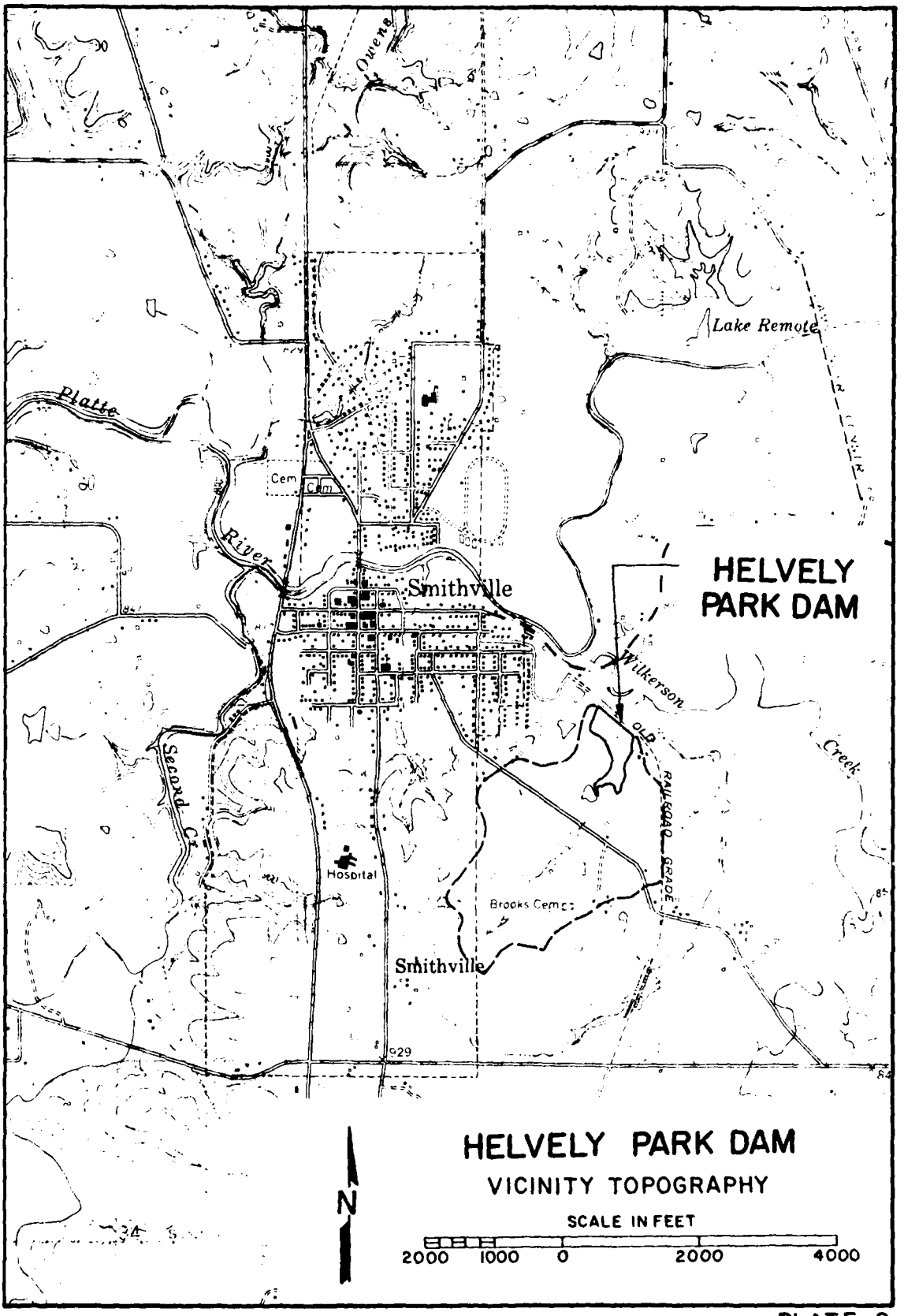
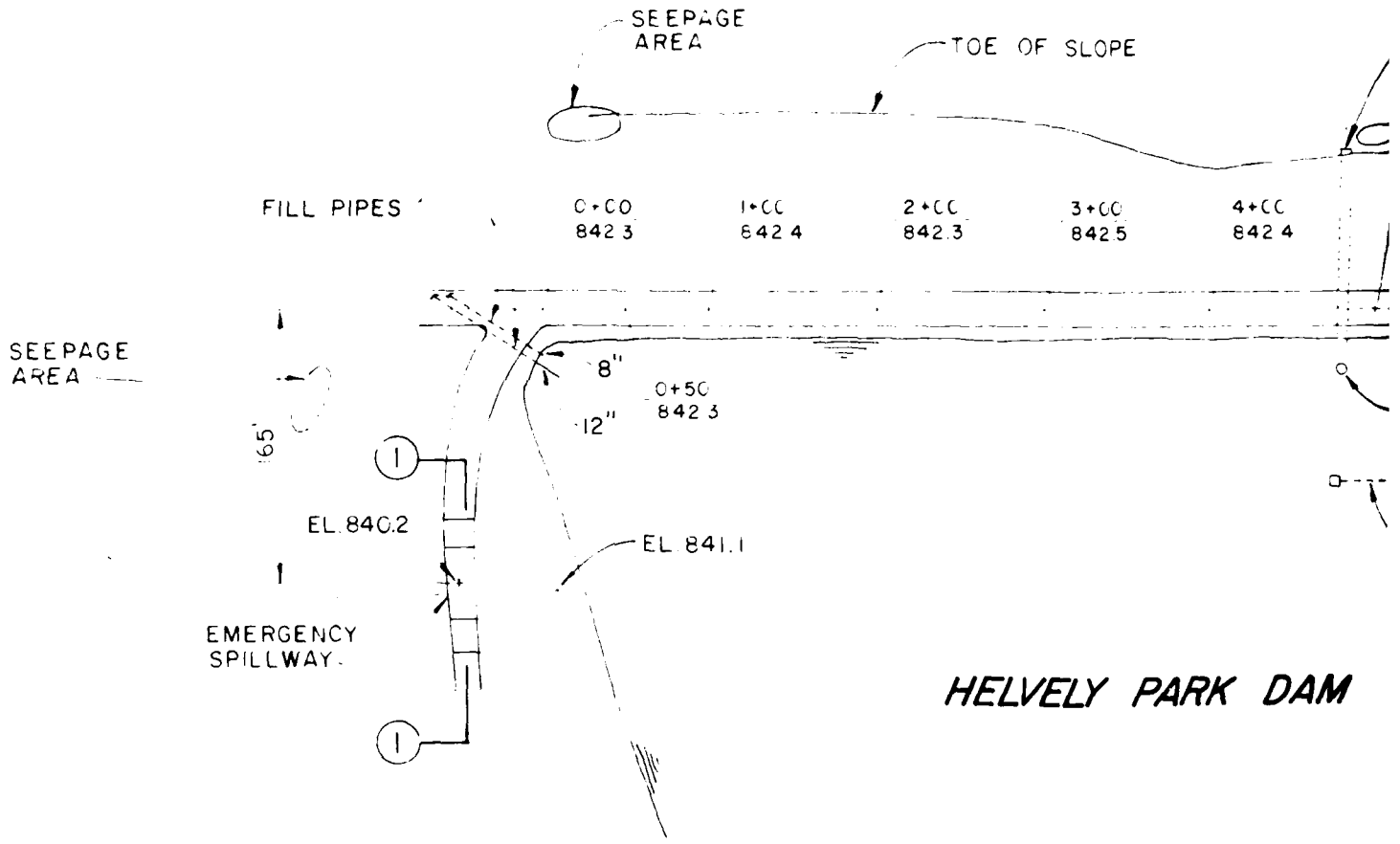
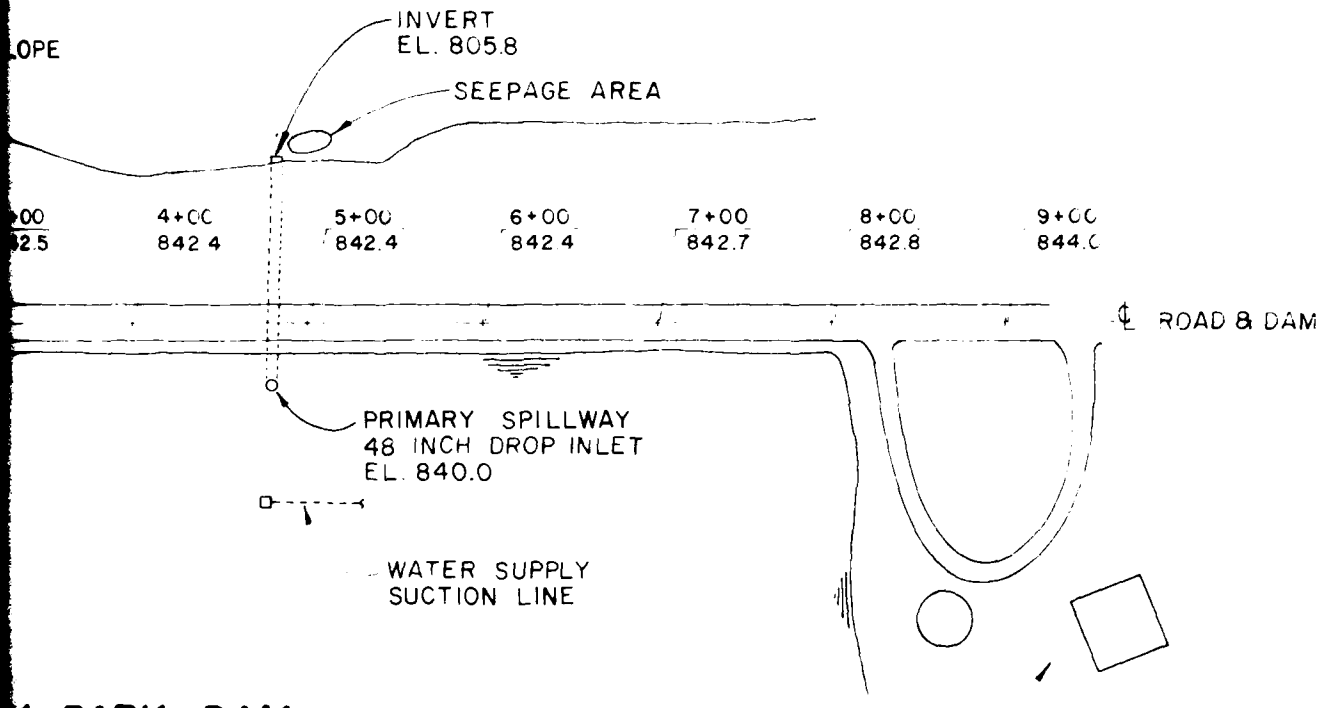

Owens
Lake Remote
Platte
River
Cem
Cem
Smithville
HELVELY
PARK DAM
Wilkerson
Creek
OLD
RAILROAD
GRADE
Second Cr
Hospital
Brooks Cemet
Smithville
929
N
HELVELY PARK DAM
VICINITY TOPOGRAPHY
SCALE IN FEET
2000 1000 0 2000 4000

PLATE 2



HELVELY PARK DAM

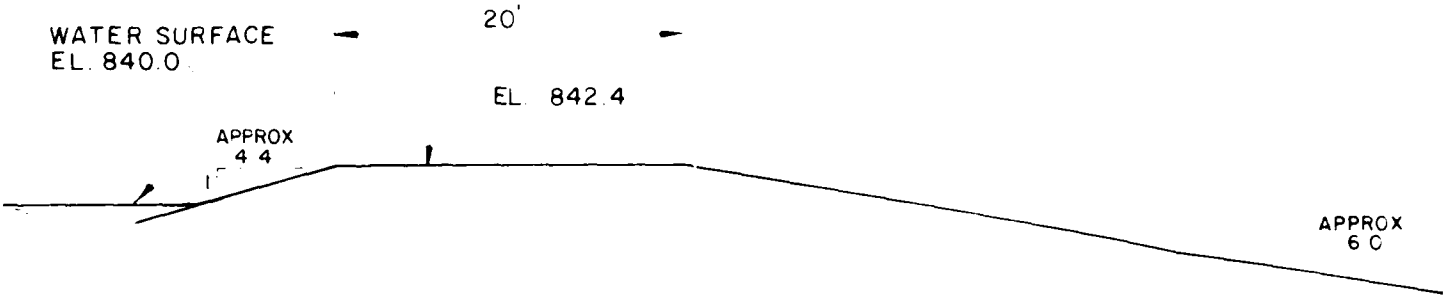


Y PARK DAM

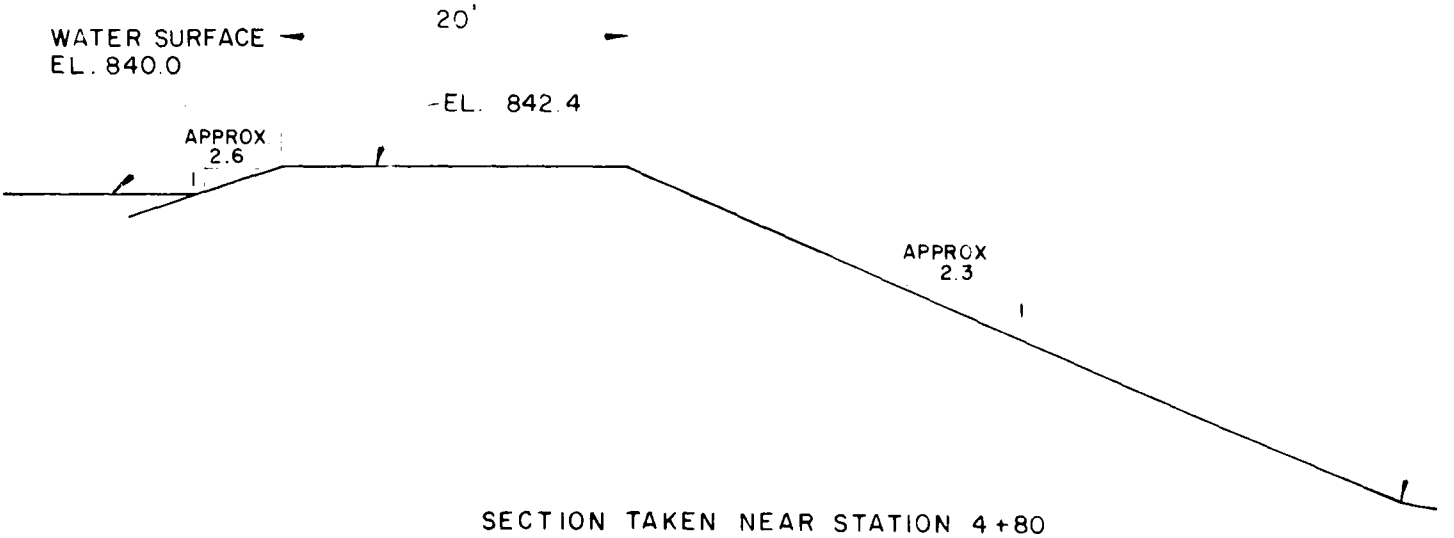
N

HELVELY PARK DAM
PLAN

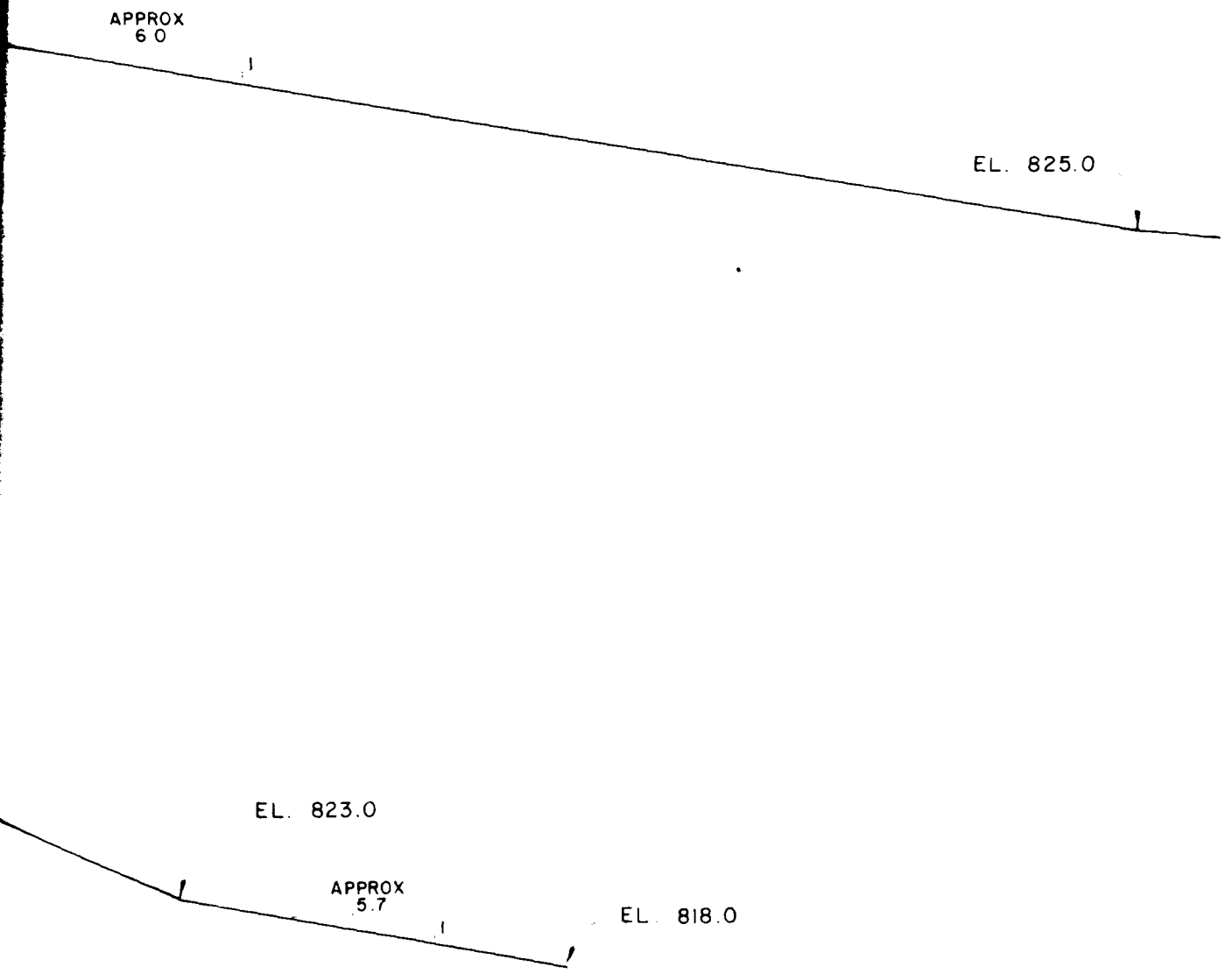
PLATE 3



SECTION TAKEN NEAR STATION 6+00
(TYPICAL BETWEEN STATIONS 0+00 AND 4+00
ALSO BETWEEN 5+40 AND 8+00)

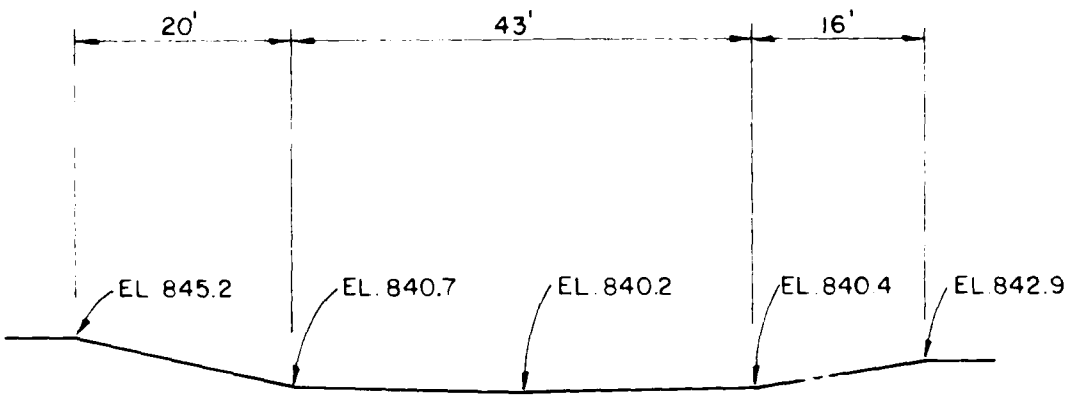


SECTION TAKEN NEAR STATION 4+80
(TYPICAL BETWEEN STATIONS 4+00 AND 5+40)



HELVELY PARK DAM
TYPICAL SECTIONS

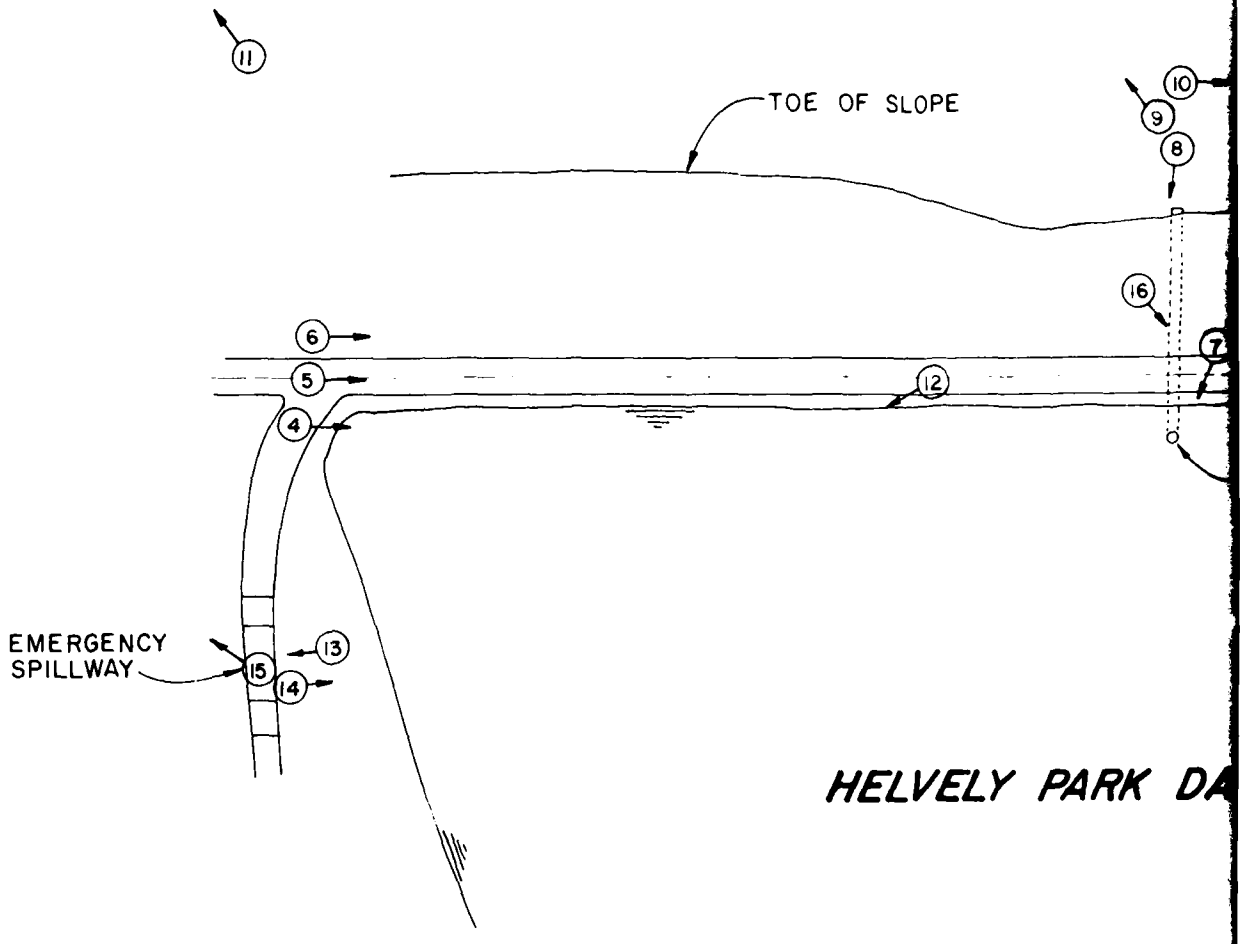
PLATE 4



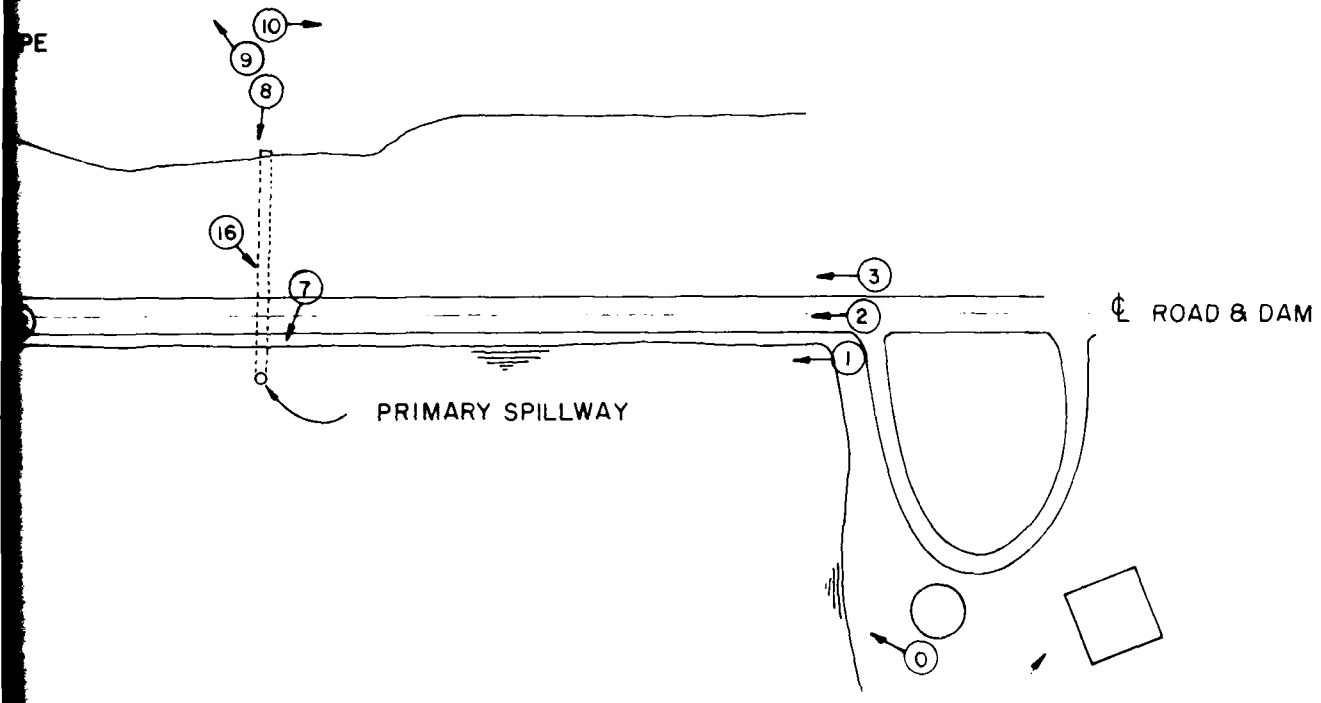
SECTION 1-1
(LOOKING DOWNSTREAM)

HELVELY PARK DAM
EMERGENCY SPILLWAY

PLATE 5



HELVELY PARK DA



ELY PARK DAM

- WATER TREATMENT PLANT

LEGEND

(1) PHOTO LOCATION AND DIRECTION

N

HELVELY PARK DAM
PHOTO INDEX

PLATE 6

PHOTO 1: UPSTREAM FACE OF DAM FROM SOUTHEAST END

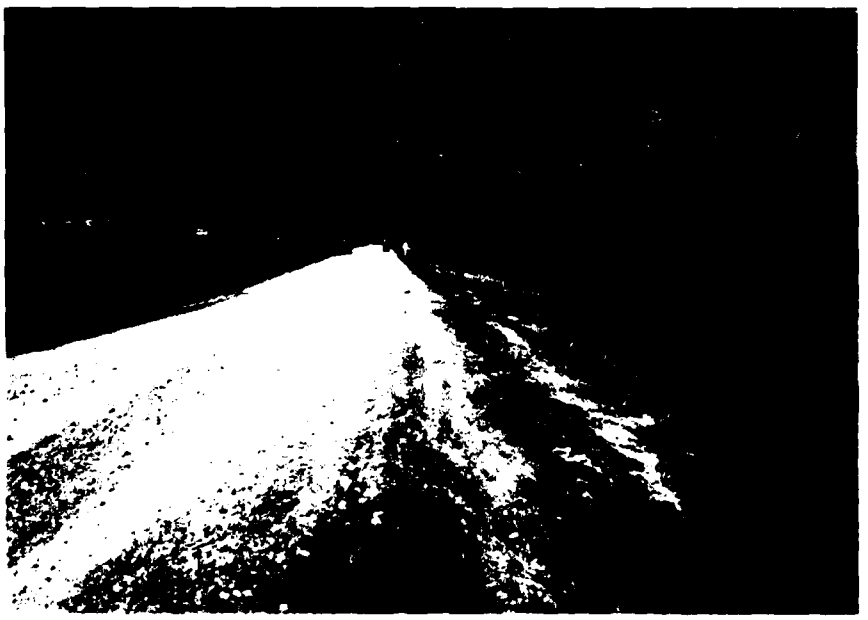


PHOTO 2: CREST OF DAM FROM SOUTHEAST END

PHOTO 3: DOWNSTREAM SLOPE OF DAM FROM SOUTHEAST END

PHOTO 4: UPSTREAM FACE OF DAM FROM NORTHWEST END

PHOTO 5: CREST OF DAM FROM NORTHWEST END

PHOTO 6: DOWNSTREAM SLOPE OF DAM FROM NORTHWEST END

PHOTO 7: PRIMARY SPILLWAY DROP INLET

PHOTO 8: PRIMARY SPILLWAY CONDUIT OUTLET

PHOTO 9: DISCHARGE CHANNEL BELOW PRIMARY SPILLWAY OUTLET

PHOTO 10: RIGHT BANK OF DISCHARGE CHANNEL

PHOTO 11: HIGHWAY DD BRIDGE OVER WILDERSON CREEK BELOW DAM

PHOTO 12: EMERGENCY SPILLWAY

PHOTO 13: EMERGENCY SPILLWAY CHANNEL CREST

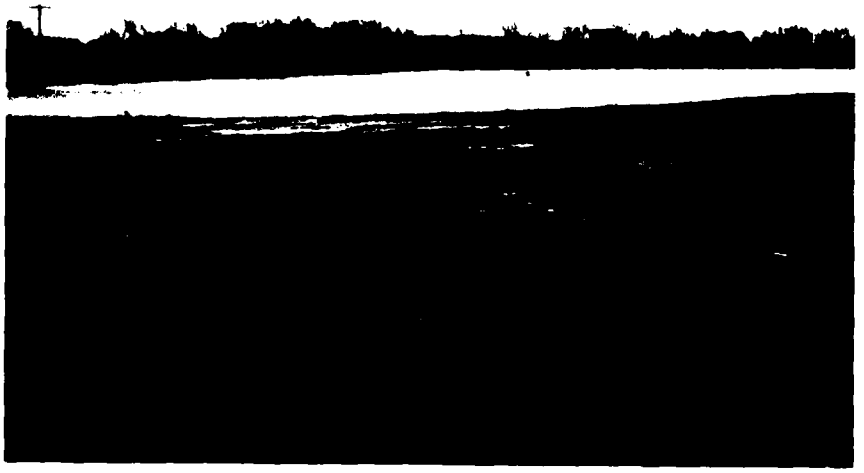


PHOTO 14: EMERGENCY SPILLWAY APPROACH CHANNEL

PHOTO 15: VALLEY BELOW EMERGENCY SPILLWAY

PHOTO 16: BLACK SLOPE OF DAM EMBANKMENT

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrographs (see Plates A-1, A-2, and A-3), and hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33.

200 square mile, 24 hour rainfall inches	- 24.5
10 square mile, 6 hour percent of 24 hour 200 square mile rainfall	- 101%
10 square mile, 12 hour percent of 24 hour 200 square mile rainfall	- 120%
10 square mile, 24 hour percent of 24 hour 200 square mile, rainfall	- 130%

b. Drainage area = 169 acres.

c. Time of concentration: $Tc = (11.9 \times L^3/H)^{0.385} = 0.25$ hours = 15 minutes (L = 0.63 miles = length of longest watercourse in miles, H = 104 feet = elevation difference in feet) (2)

d. The soil association in this watershed is mainly Gara-Armster (3).

e. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 82 and antecedent moisture condition III. The hydrologic soil groups in the basin were B and C.

2. Spillway release rates are based on a combination of both the sharp-crested weir equation and the orifice equation and the broad-crested weir equation.

Combined sharp-crested weir and orifice equation:

$Q = C_o (2 R_s) H_o^{1.5}$ (C_o = 3.8 to 1.0 - varying with approach depths and types of flow, R_s = 2.0 feet = radius of the pipe in feet for the principal spillway, H_o is the head on the weir in feet) (2).

Broad-crested weir equation:

$Q = CLH^{1.5}$ (C = 2.6, L = 43 to 79 feet for the emergency spillway, H is the head on the weir in feet).

Discharge rates over the top of the dam are also based on the broad-crested weir equation:

$$Q = CLH^{1.5} \text{ (C = 2.6 to 2.9, L = 270 to 1,030 feet).}$$

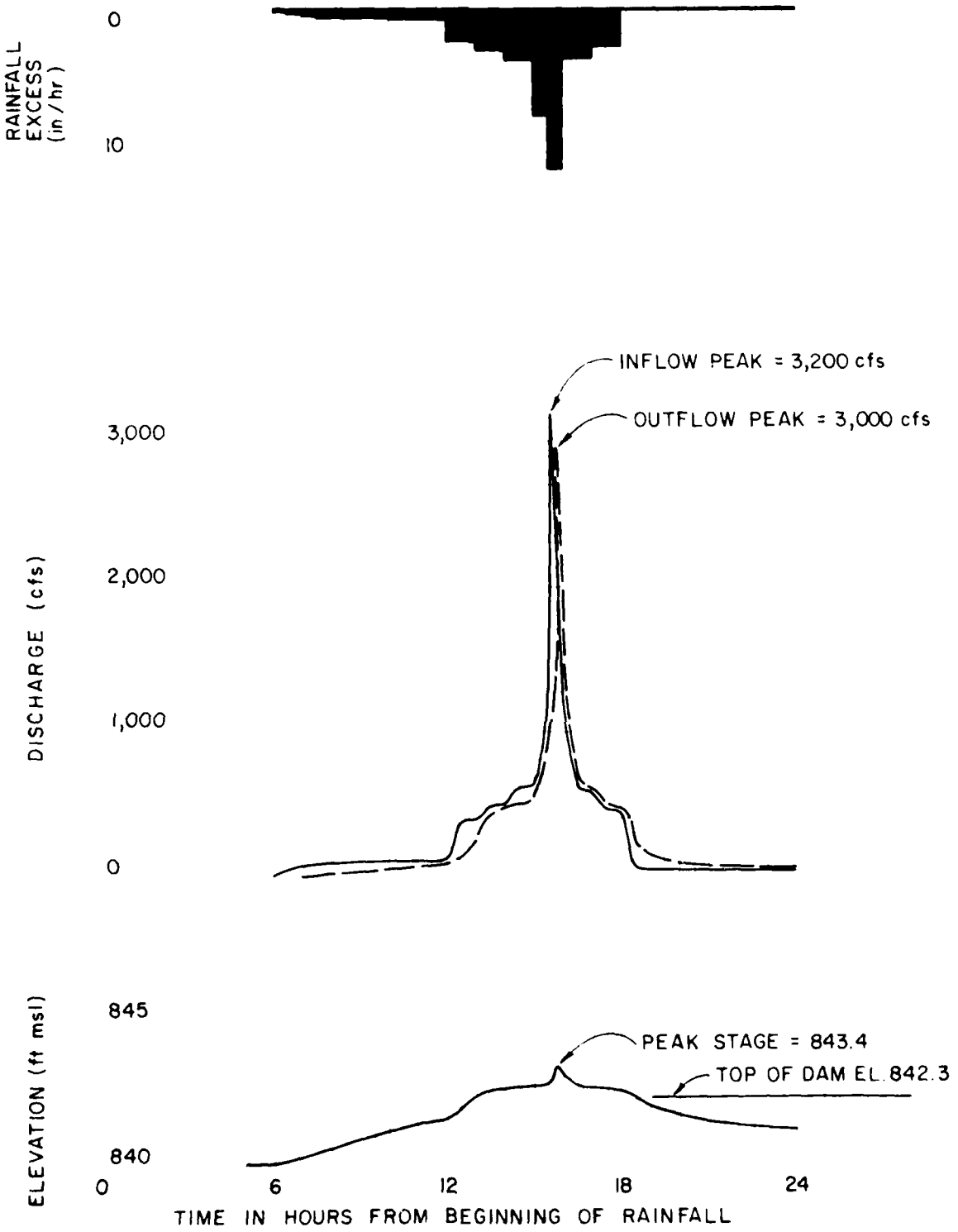
3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

4. Floods are routed through the spillway using HEC-1, modified Puls to determine the capability of the spillway. Inflow and outflow hydrographs are shown on Plates A-1, A-2, and A-3.

(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, Davis, California.

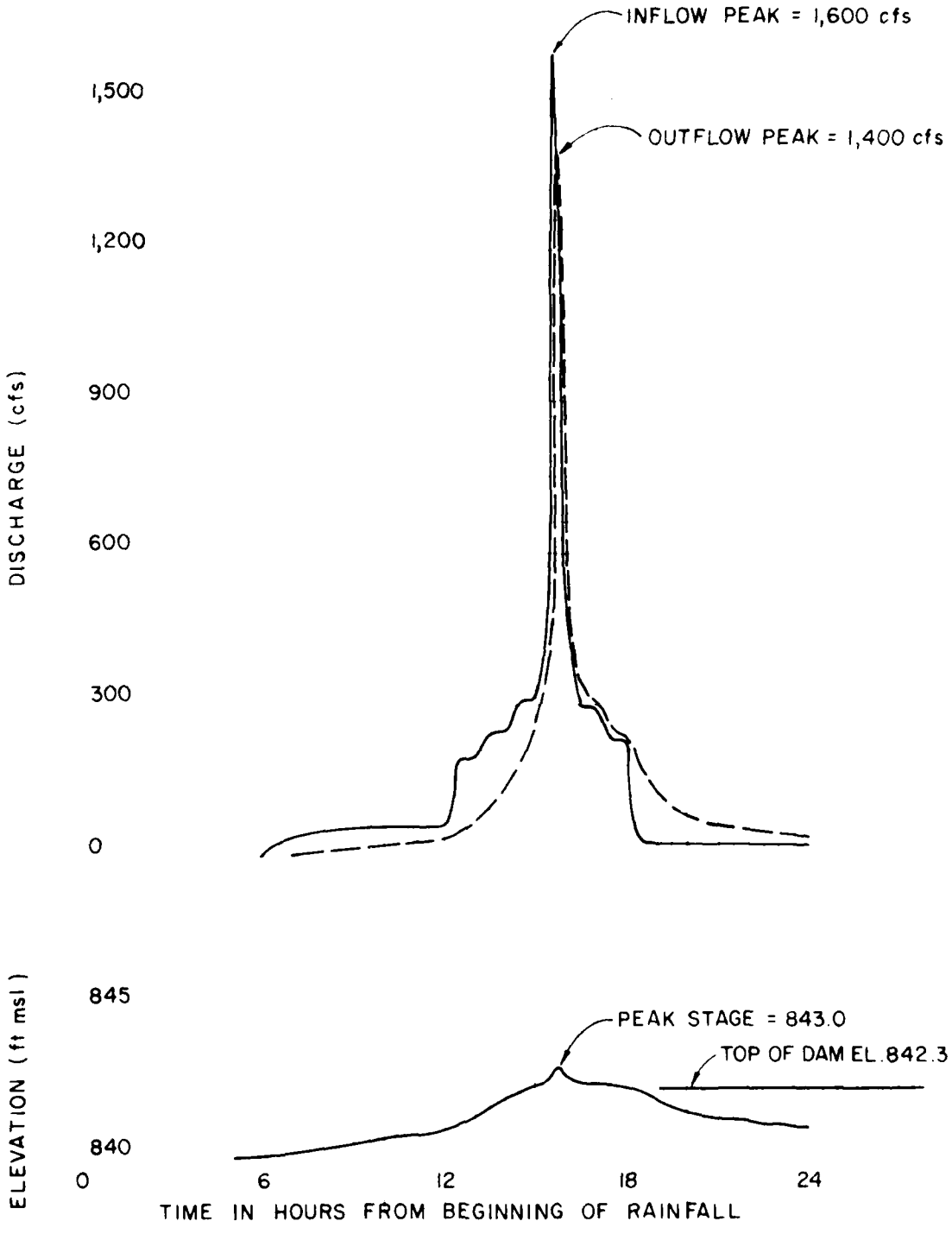
(2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.

(3) Mid-America Regional Council, Regional Soils Guide, March 1976, Kansas City, Missouri.



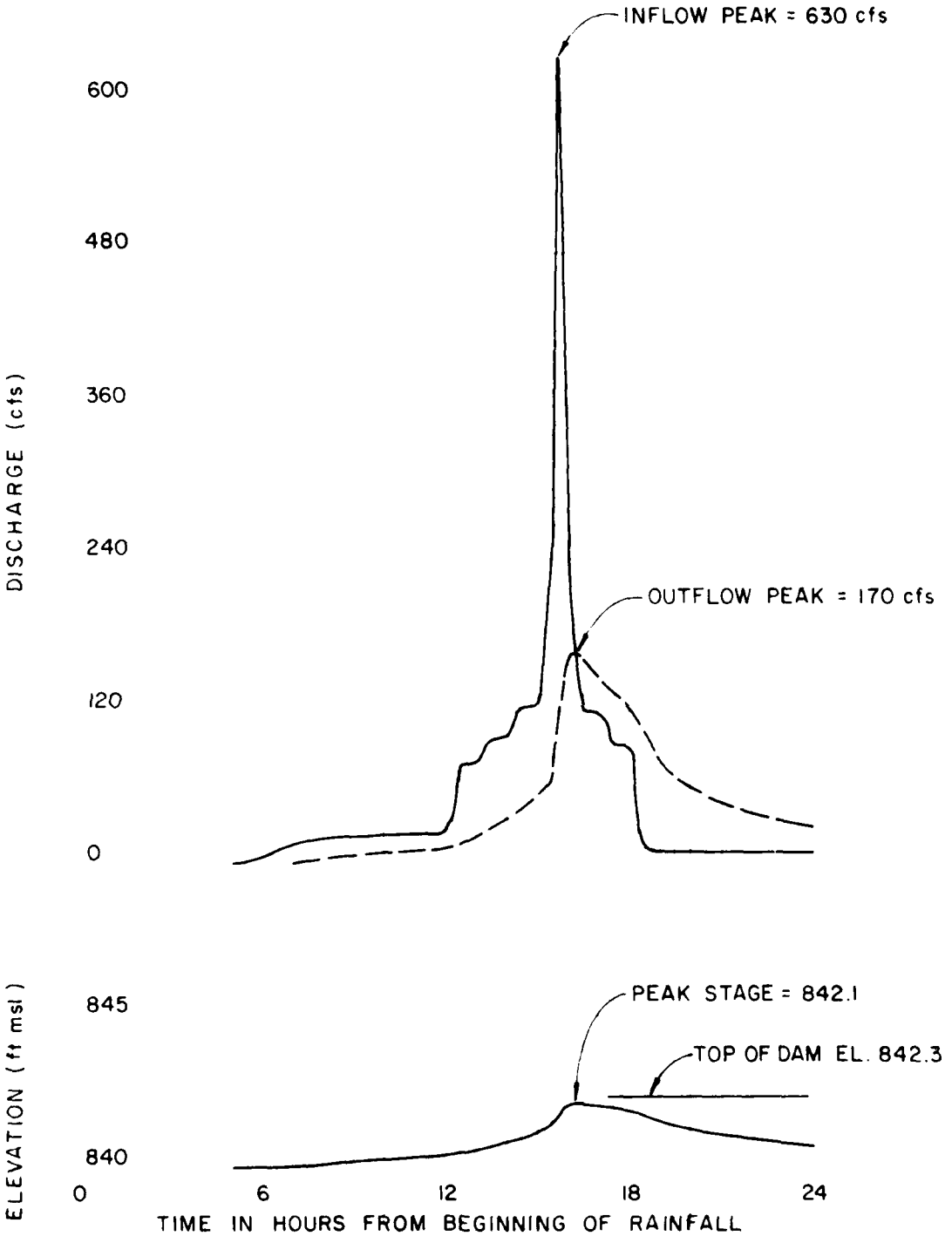
HELVELY PARK DAM
PROBABLE MAXIMUM FLOOD
HYETOGRAPH, HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-1



HELVELY PARK DAM
50% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-2



HELVELY PARK DAM
20% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-3

```
**********  **********
FLOOD HYDROGRAPH   PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  25 SEP 78
**********  **********
    1                 A1***** NONAME DAM # 169  - MISSOURI DAM INSPECTION STUDY *****
    2                 A2ROUTING COMPUTATION FOR NONAME DAM # 169 RESERVOIR
    3                 A3DRAINAGE AREA = 169 ACRES = 0.264 SQ.MI.
    4                 B     288       0       5       0       0       0       0       0       0       0
    5                 B1      5
    6                 J       1       9       1
    7                 J1    .1      .15      .2     .25      .3     .35      .4      .5      1.
    8                 K       0       1                               3       1
    9                 K1 NONAME DAM # 169  (24HR. PROBABLE MAXIMUM RUNOFF)
   10                 M       1       2   0.264                       1
   11                 P             24.5     101     120     130
   12                 T                                                       -1     -82
   13                 W2            0.15
   14                 X                       1
   15                 K       1       2                                       1
   16                 K1 ROUTING THROUGH NONAME DAM # 169 RESERVOIR
   17                 Y                                       1       1
   18                 Y1      1                                               -1      -1
   19                 Y4 840. 840.5   841.    841.1   841.5   842.    842.3   842.4   842.5   842.6
   20                 Y642.7 842.8    842.9   843.    843.5   844.    845.    846.
   21                 Y5 0.   17.     42.     47.     73.     140.    200.    240.    320.    460.
   22                 Y5640.  660.    1120.   1420.   3350.   5870.   12400.  20500.
   23                 $S 0.   192.
   24                 $E 840. 650.
   25                 $$ 840.0
   26                 $D 842.3      0.      1.5     0.
   27                 K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				.10	.15	.20	.25	.30	.35	.40	.50	1.00
HYDROGRAPH AT	1	.26	1	317.	476.	634.	793.	951.	1110.	1268.	1585.	3170.
		(.68)		(8.98)(	13.47)(	17.96)(	22.44)(	26.93)(	31.42)(	35.91)(	44.89)(	89.78)
ROUTED TO	2	.26	1	53.	98.	166.	302.	500.	822.	1019.	1388.	2957.
		(.68)		(1.50)(	2.76)(	4.69)(	8.55)(	15.86)(	23.27)(	28.87)(	39.30)(	83.73)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	840.00	840.00	842.30
STORAGE	0.	0.	44.
OUTFLOW	0.	0.	200.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	841.19	0.00	23.	53.	0.00	17.17	0.00
.15	841.68	0.00	32.	98.	0.00	16.33	0.00
.20	842.13	0.00	41.	166.	0.00	16.17	0.00
.25	842.48	.18	48.	302.	.92	16.00	0.00
.30	842.66	.36	51.	560.	1.50	15.92	0.00
.35	842.78	.48	53.	822.	1.92	15.83	0.00
.40	842.86	.56	55.	1019.	2.58	15.83	0.00
.50	842.99	.69	57.	1388.	3.67	15.75	0.00
1.00	843.40	1.10	65.	2957.	5.67	15.75	0.00